Excess Capacity Measurement in Western Pacific & the Implications to Fishery Management

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Presentation Outline

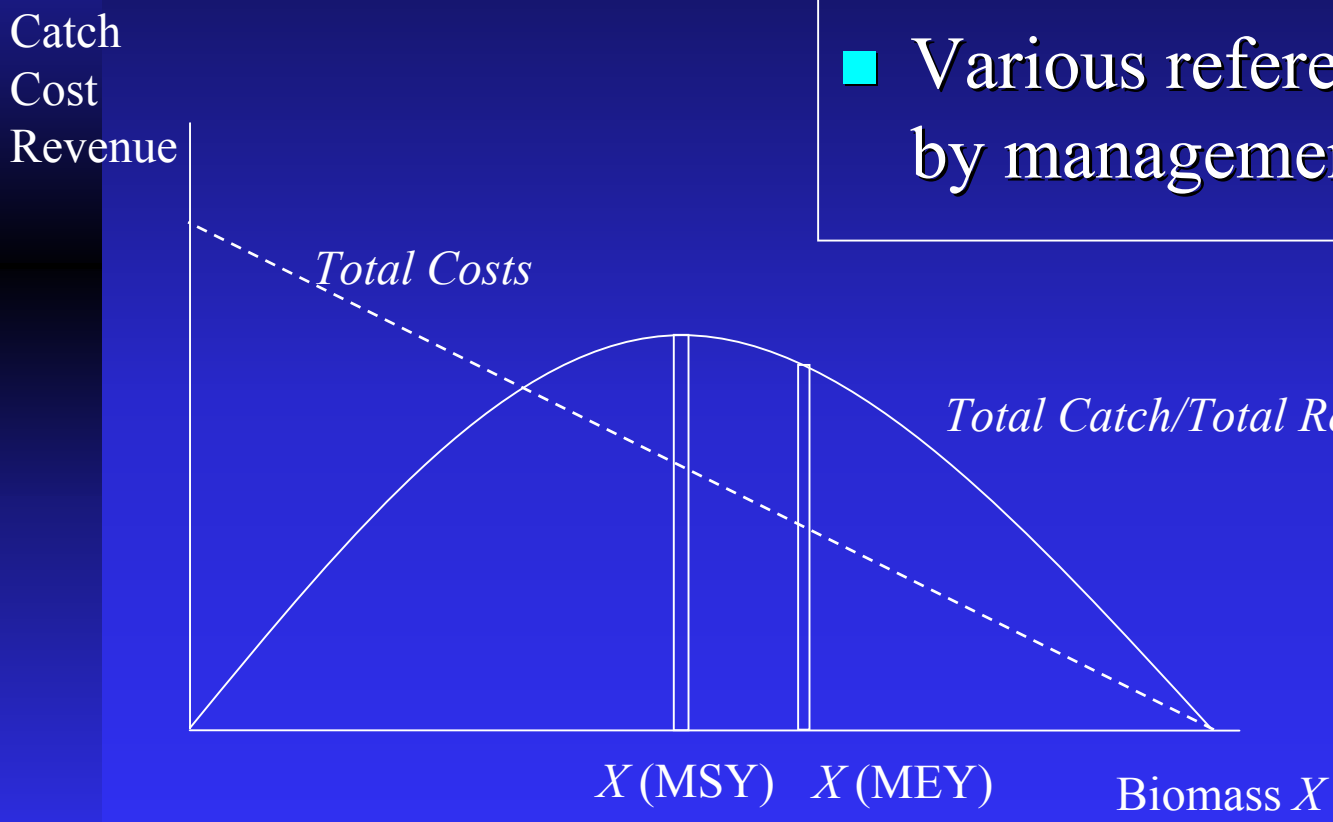
- Difficulties
- Results in Western Pacific Region
- Result evaluation

Definition of Capacity

- Capacity of a fleet – harvest capacity
  - Physical description
    - Vessel size (length, tonnage)
    - Number of vessels
  - Measured by output
    - The amount of fish that a vessel or a fleet *is able to* catch
- Capacity of a stock – resource capacity

Resource Capacity

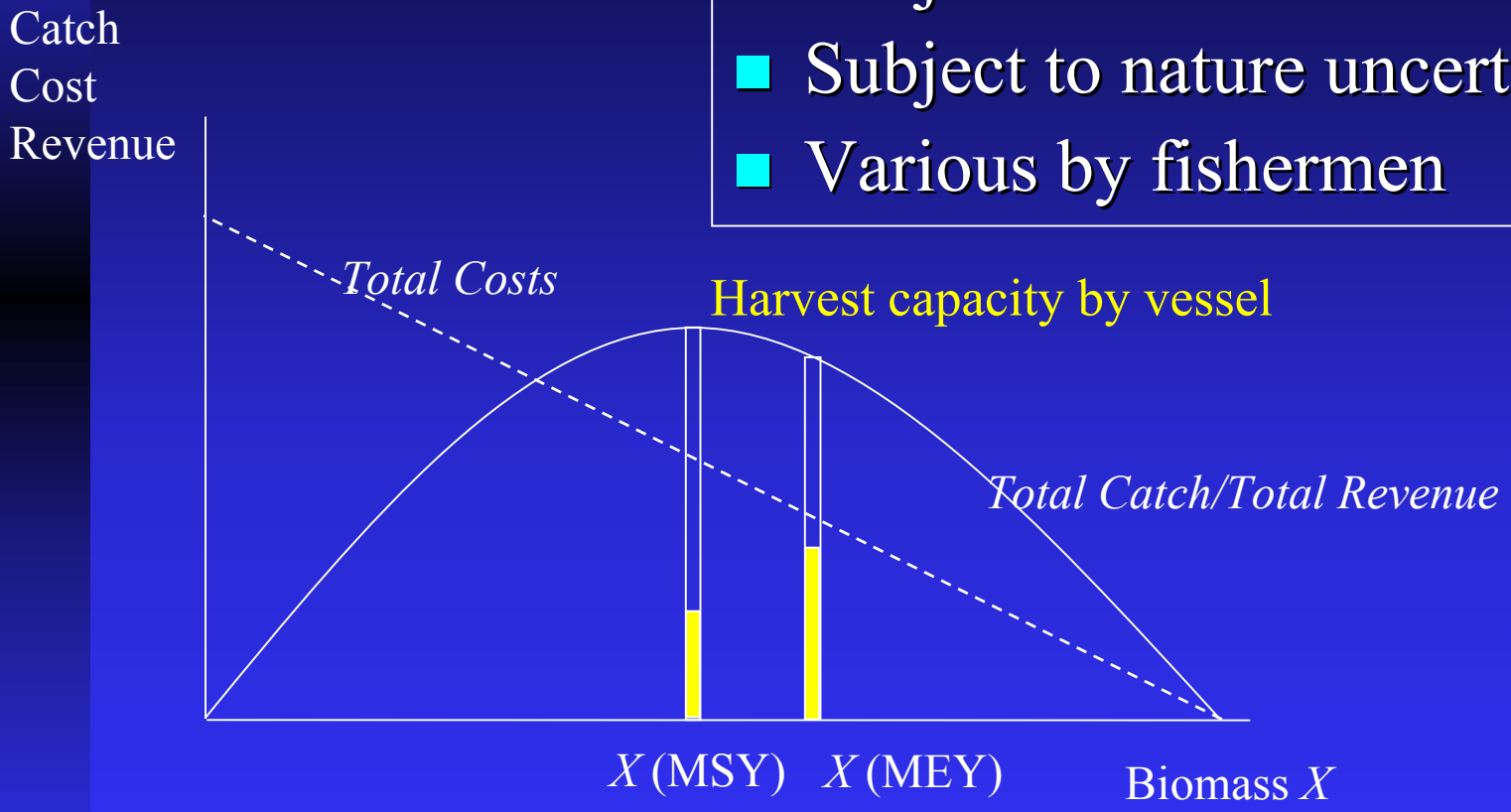
- Given by the nature
- Various reference points by management goals



Gordon-Schaefer Model

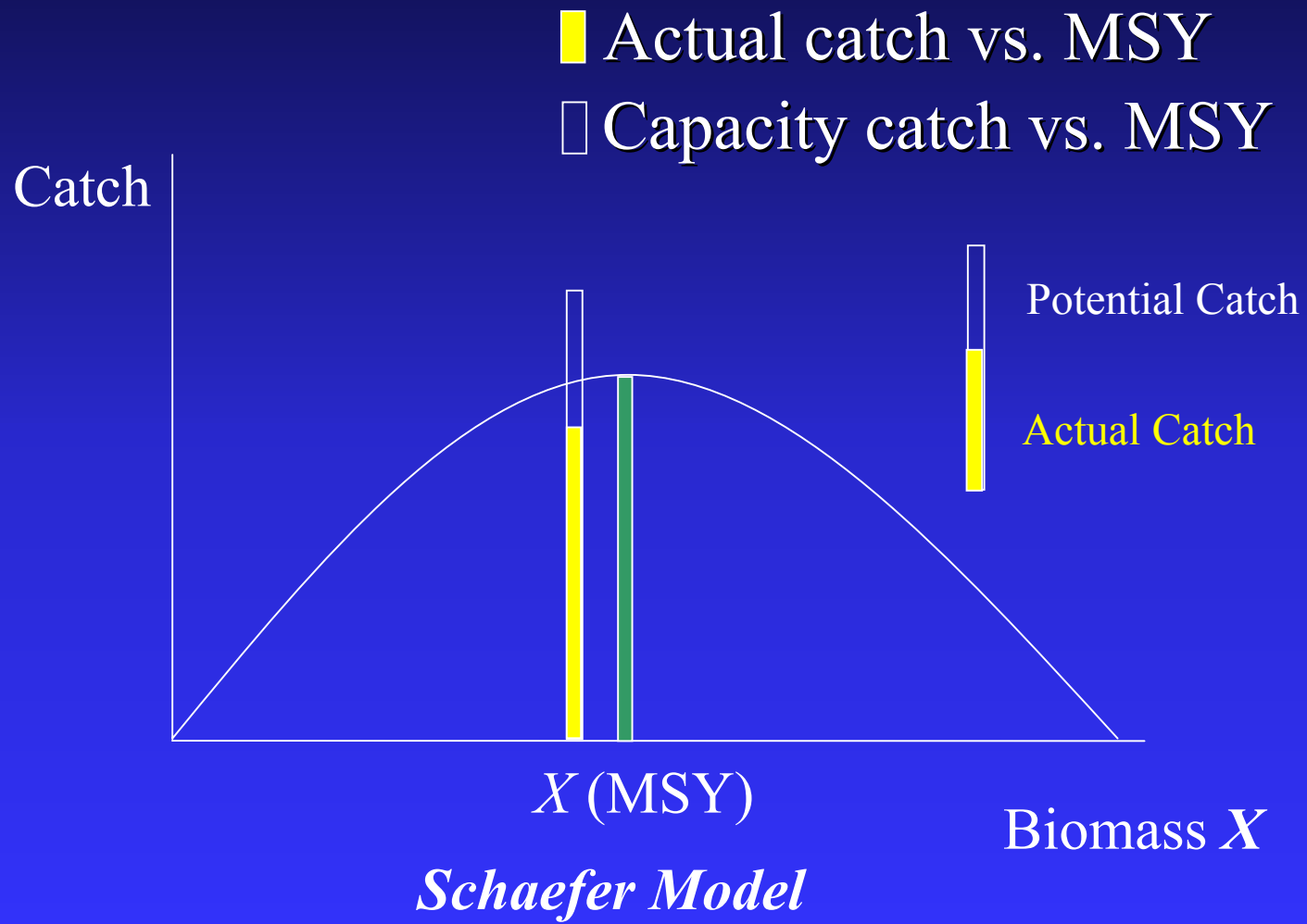
Harvest Capacity – moving target

- Given by a fleet/vessel
- Subject to fish abundance
- Subject to nature uncertainty
- Various by fishermen



Gordon-Schaefer Model

Excess Capacity of a Fish Stock = "Overcapacity"



Three Methods Suggested by the National Task Force

- Peak-to-peak approach
- Stochastic production frontier
- Data envelopment analysis (DEA)

✓ Create an index (coefficient): capacity utilization level (CUL)

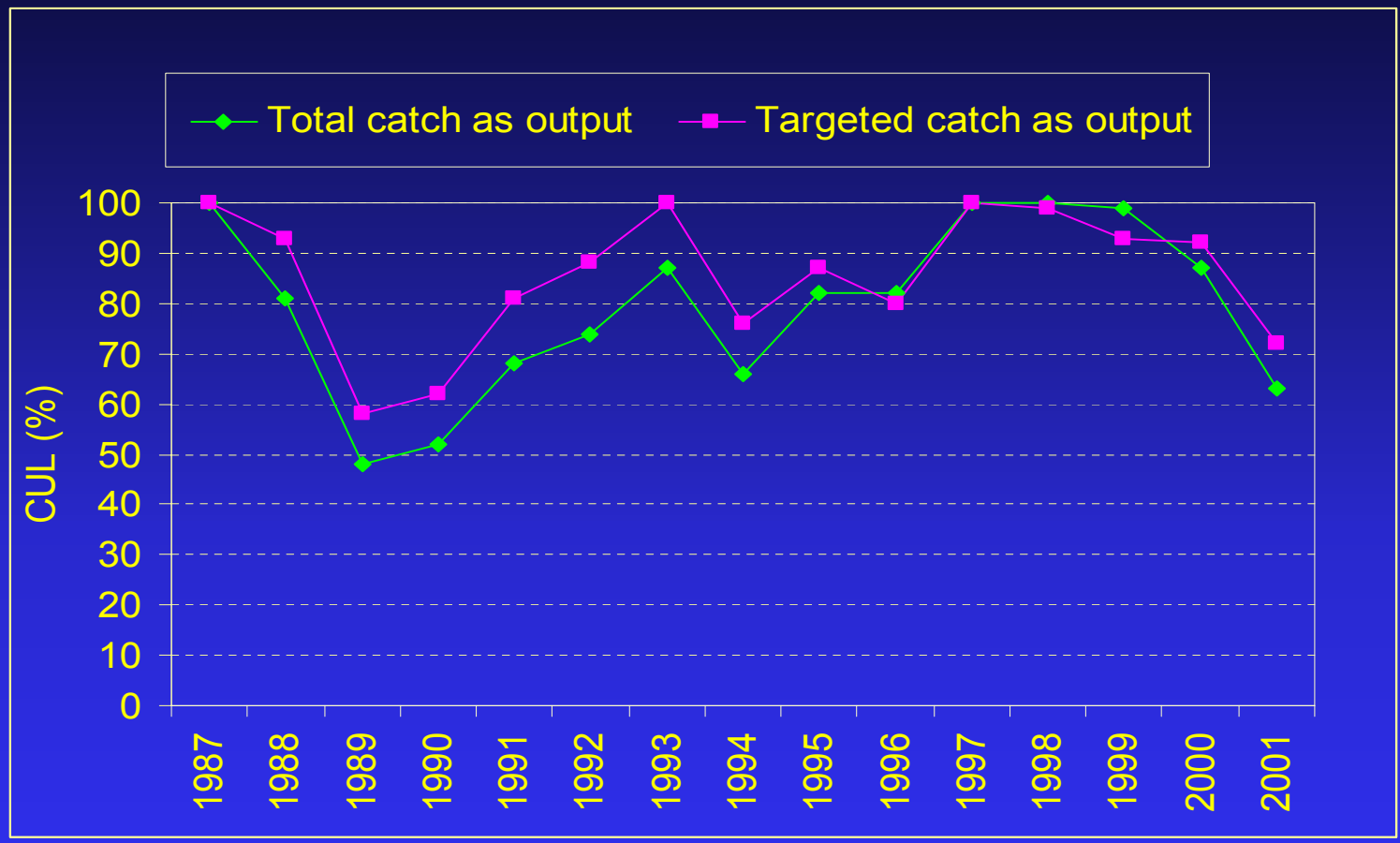
$$CUL = Y/Y^*$$

Y: Actual output

Y*: Potential output or capacity output

-- the best in a history if time-series data are used

Input and Output Definitions



Excess capacity assessment of Hawaii longline fishery under different output definitions

Excess Capacity

- CUL = 1 -- No excess capacity
- CUL < 1 -- Excess capacity exits -- a fleet *is able to* harvest more than it presently does
- Causes of excess capacity
  - ✓ Technical inefficiency/technology changes
  - ✓ Weather conditions
  - ✓ Stock abundance
  - ✓ Regulatory impact
  - ✓ Too many boats

Excess Capacity Assessment of Four Main Fisheries in Western Pacific

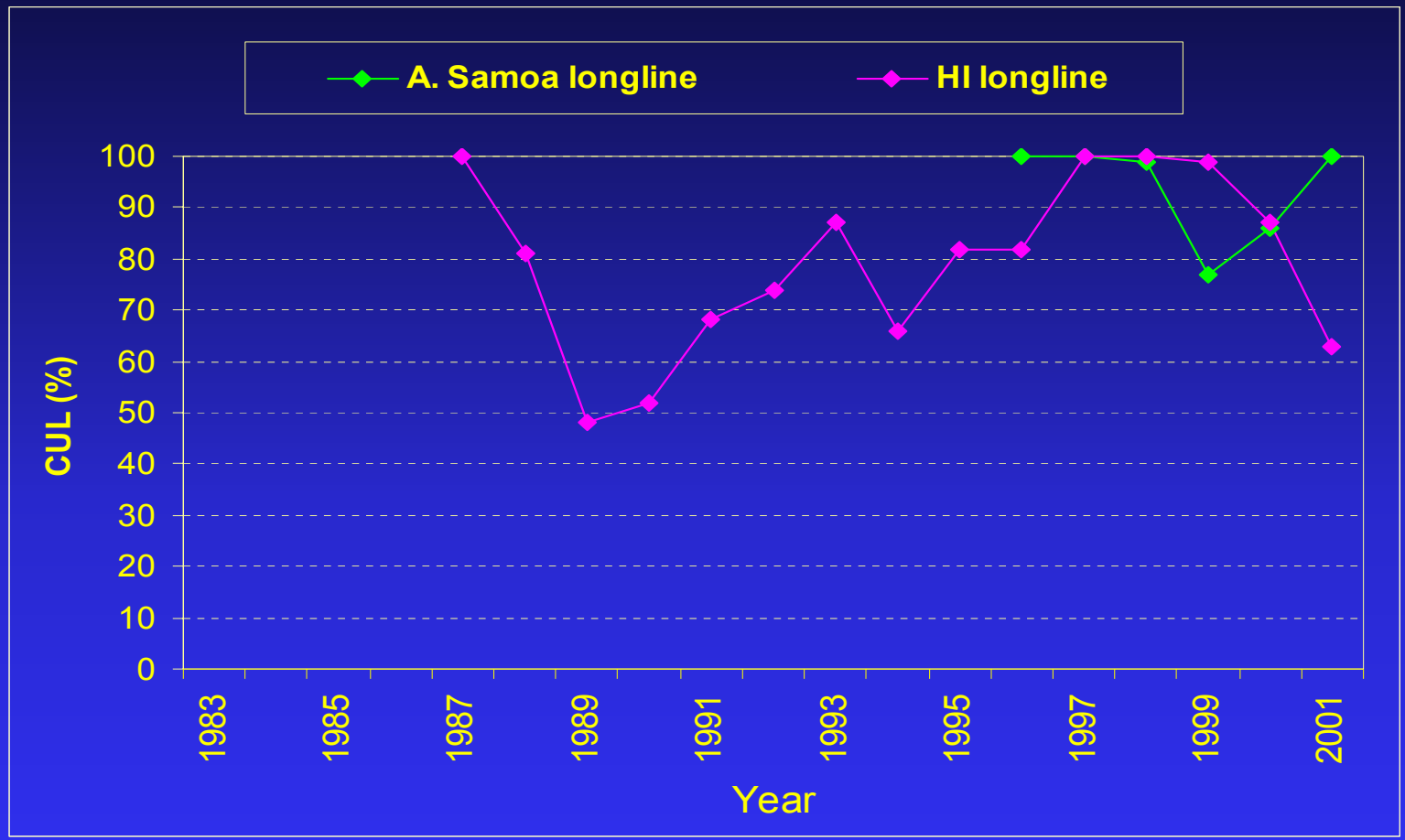
Fleet	Output varaible	Input variables	Data period	Average CUL*	Possible excess capacity
Hawaii Longline	Landings	# of vessels, # of trips	1987-2001	79%	21%
A. Samoa Longline	Landings	# of vessels, # of hooks	1996-2001	94%	6%
NWHI Bottomfish	Landings	# of vessels, # of trips	1984-2001	73%	27%
NWHI Lobster	Landings	# of vessels, # of traps-hauls	1983-1999	67%	33%

* Estimated by DEA (data envelopment analysis)

Would Excess Capacity be a Problem?

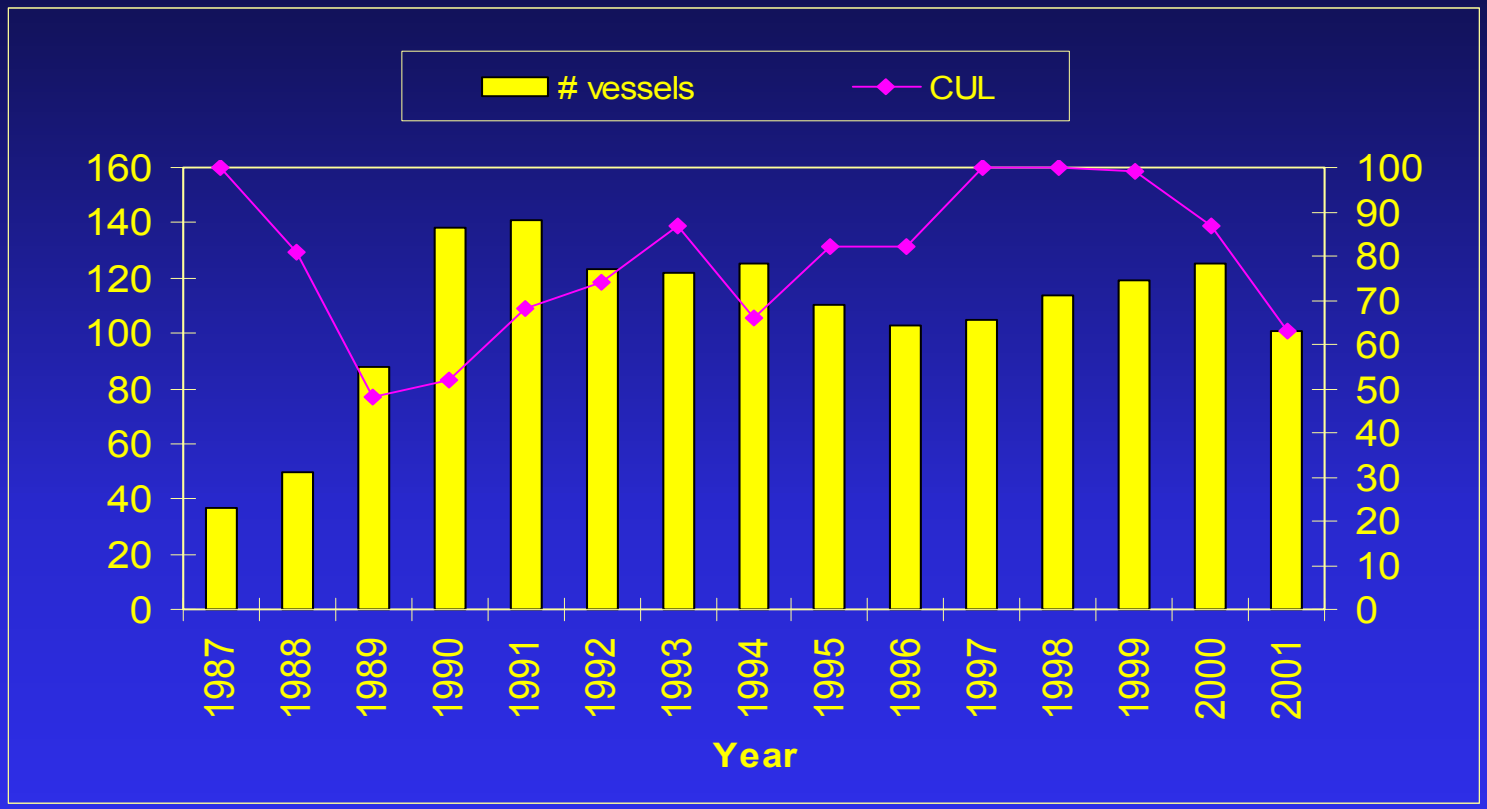
- Examining the trend
- Examining the causes

Time Trends of Excess Capacity of the Two Longline Fisheries



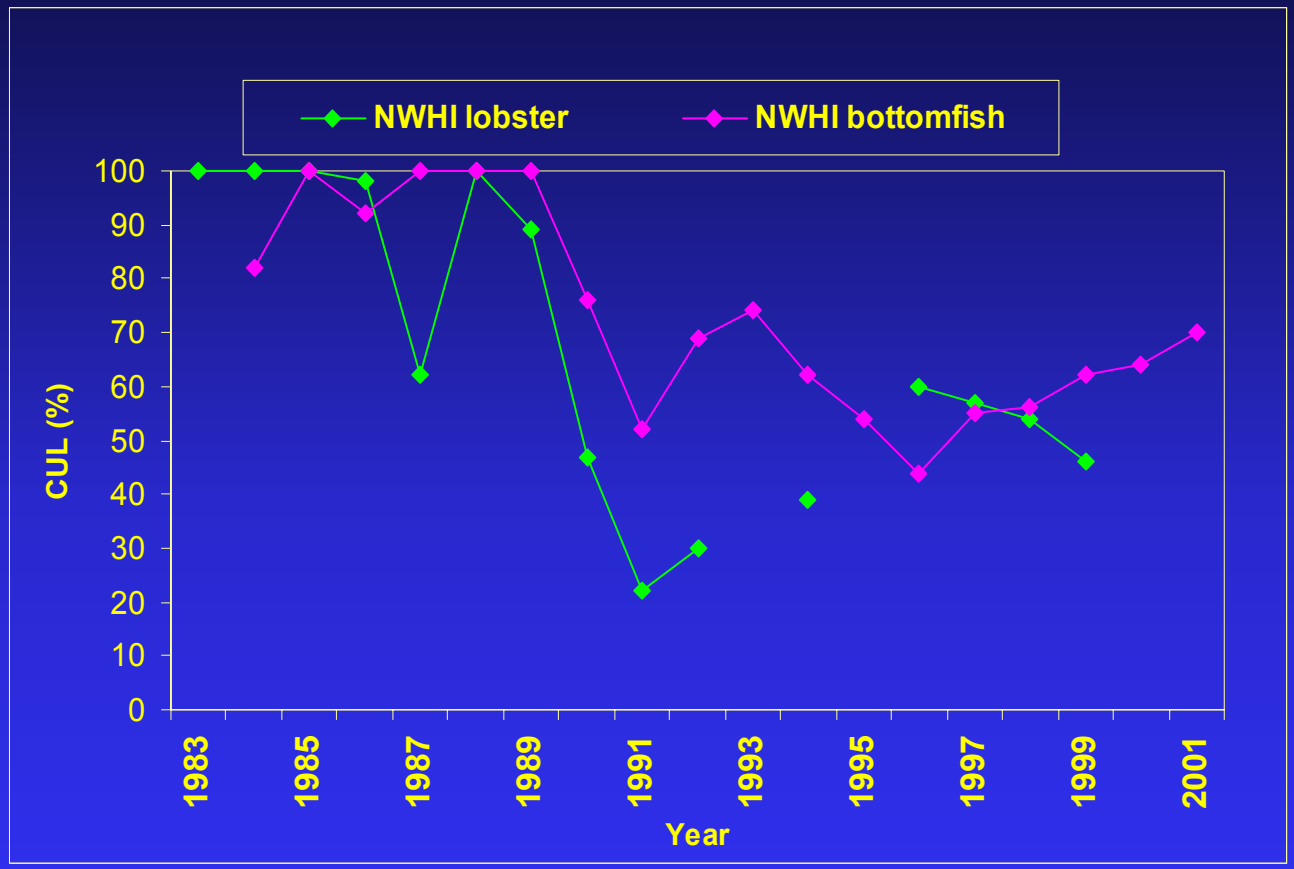
☞ No obvious decline or increase trend in excess capacity

Hawaii Longline Fleet Size vs. Excess Capacity



- Excess capacity may be not a result from too many boats

Time Trends of Excess Capacity of the NWHI Lobster and Bottomfish



Bottomfish
84-01: 17%
84-89: 4%
90-01: 39%

Lobster
83-99: 23%
83-89: 7%
89-99: 66%

☞ Excess capacity increases overtime in both fisheries

Factors that May Cause Increase of Excess Capacity (NWHI lobster)

- Fish stock (CPUE) declined

	CPUE	CUL	Excess Capacity
1983-1989	2.4 lobsters/trap	93%	17%
1990-1999	1.4 lobsters/trap	44%	56%

- Regulation changed

	CPUE	Harvest Guideline	CUL	Excess Capacity
1989	1.71	None	100%	0%
1997	1.75	310,000	75%	25%

Regress Analysis on Excess Capacity of NWHI Lobster Fishery

Regressor	Coefficient (*t* value)
Constant	70.15 (5.37*)
Stock index (CPUE)	9.79 (1.77**)
Regulation change in 1991 (harvest guideline)	-36.01 (-3.86*)
Regulation change in 1998 (harvest guideline by zone)	-34.45 (-2.80*)

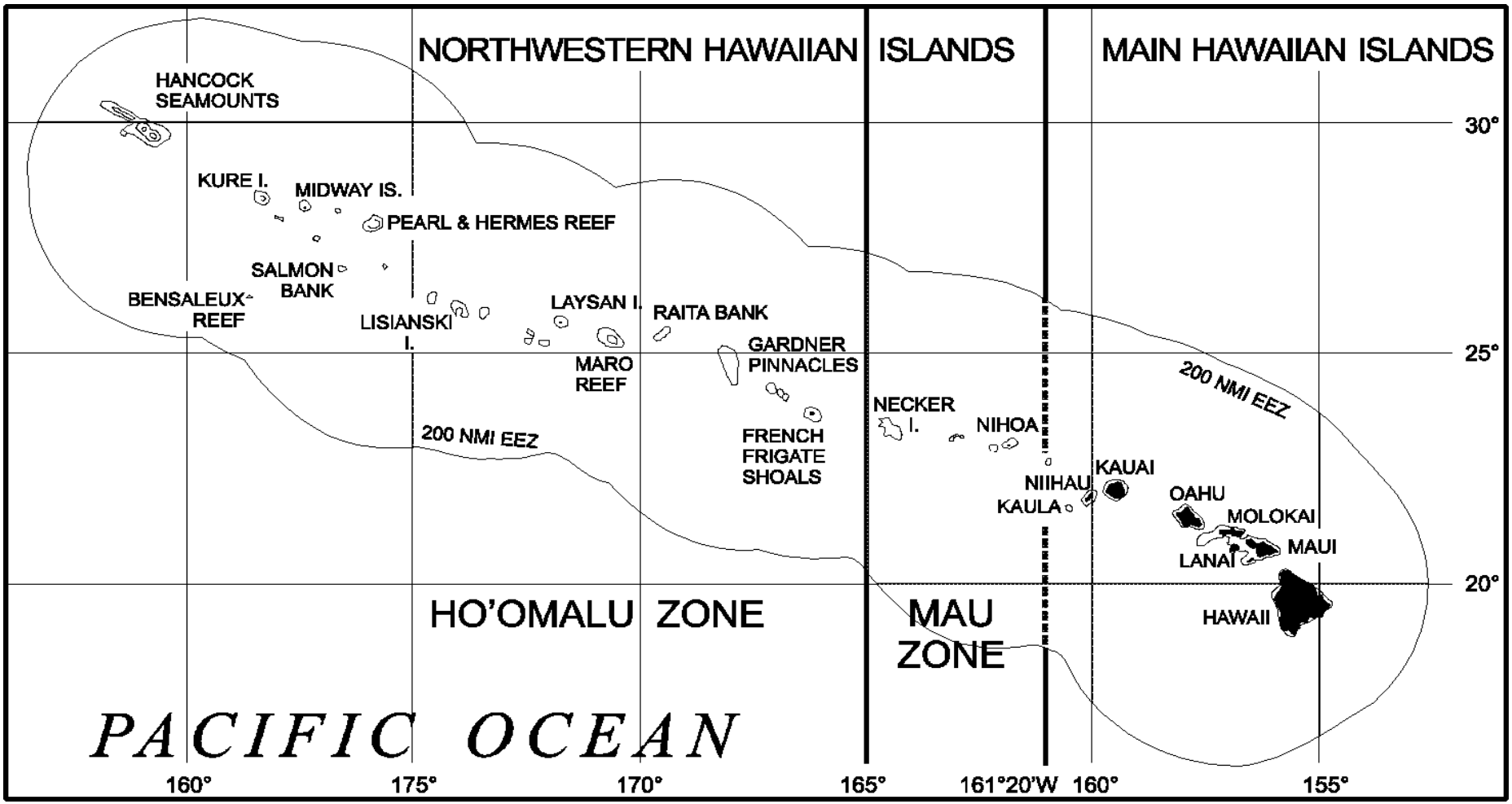
1. * Significant at 5% level, & ** significant at 10% level
2. R^2 adjusted = 0.72

Regress Analysis on Excess Capacity of NWHI Bottomfish Fishery

Regressor	Coefficient (*t* value)	Coefficient (*t* value)
Constant	-2.80 (0.10)	71.24 (3.59*)
Stock index SPR (spawning potential ratio)	1.43 (2.68*)	.46 (1.38)
Regulation change in 1990 (two zones)		-32.64 (-5.78*)
R^2 adjusted	.29	.79

* Significant at 5% level

NWHI Bottomfish Area Closure



Summary of Regression Analysis

- Both stock abundance and regulation changes show significant impact on excess capacity
  - Stock abundance ↑, excess capacity ↓
  - Regulations (TAC or area closure), excess capacity ↓
- 72% of the excess capacity can be explained by regulatory and stock changes in the NWHI lobster fishery
- 79% for the NWHI bottomfish fishery

Conclusions

- Capacity is a moving target for fishery industry
- Excess capacity may cause by various factors beside “there are too many boats”
- Necessary to examine the causes of excess capacity before excess capacity measurement is applied to fishery management
- Regression analysis provide a useful tool to evaluate the excess capacity estimated by the frontier methods or Peek-to-peek method
  - Regulatory regime
  - Stock status

Question?